# OCCUPATIONAL EXPOSURE TO LEAD

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## 1. GENERAL

**1.01** This section provides information on the evaluation and control of exposure to lead in the workplace, as required by the Occupational Safety and Health Act and published in Title 29 of the Code of Federal Regulations (CFR) 1910.1025 and accompanying appendices.

**1.02** When this section is reissued, the reasons for reissue will be given in this paragraph.

**1.03** Bell System documentation on specific work operations that have been identified as potentially exposing employees to airborne lead particles or dust are referenced as follows:

| SECTION | TITLE |
|---|---|
| 081-852-127 | Lead Particle Entrapment Compound (LEPEC)—Description |
| 620-100-010 | Occupational Exposure to Lead—Cable Removal |
| 627-380-240 | Aerial Cable Removal |
| 628-240-240 | Removing Underground Cable |
| 628-240-242 | Removing Underground Cable—High Production Method |
| 632-020-240 | Cable Removal—Cutting Splice Closures From Plant |
| 632-315-200 | Removing Lead Sheath—General |
| 633-200-201 | Lead-Calcium Sleeves—Description and Installation |
| 644-200-005 | E Sheath Repair Sleeving (AT-8743)—Description and Installation |
| 649-210-132 | Cable Removal Unit—Hogg-Davis—Description and Operation |
| 649-210-135 | MCV Mobile Cable Salvaging Vehicle—Description and Operation |
| WIP 147A | Occupational Lead Exposure |

**1.04** The following terms are commonly used and are defined as follows:

| | |
|---|---|
| OSHA | -Occupation Safety and Health Administration |
| NIOSH | -National Institute for Occupational Safety and Health |
| Lead | -Metallic Lead (symbol Pb), all inorganic lead compounds and organic lead soaps |
| $\mu g/m^3$ | -Micrograms per cubic meter of air, the unit of measure for airborne lead concentration |
| $mg/m^3$ | -Milligrams per cubic meter of air |
| PEL | -Permissible exposure limit for lead; established by law as |

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| | |
|---|---|
| | 50 $\mu g/m^3$ averaged over an 8-hour period |
| Action Level | -An airborne lead concentration of 30 $\mu g/m^3$ averaged over an 8-hour period; triggers certain compliance activities |
| PbB | -Blood lead level usually expressed in micrograms per 100 grams of whole blood ($\mu g/100g$) |
| TWA | -Time weighted average, the average value of contaminant in air during a specific time period |
| ZPP | -Zinc protoporphyrin, a substance found in the red blood cells; testing for ZPP is sometimes used as a screening technique for chronic lead exposure. |

## 2. HEALTH ASPECTS OF LEAD

**2.01** Lead is a common metal and is found in varying amounts virtually everywhere, from the crust of the earth to the air, water, and in the human body.

**2.02** Lead has a number of properties which make it desirable for use in a wide variety of products and many industrial processes.

**2.03** From these various sources small amounts of lead enter the body either through inhalation, ingestion, or absorption through the skin. By virtue of normal body processes (respiration and elimination) the majority of this lead is naturally purged. Since the excretion process is relatively slow, lead tends to accumulate in body tissues with continued elevated exposures.

(a) ***Inhalation*** is the respiratory process by which lead dust and fumes enter the lungs. That which is not exhaled passes from the lungs into the bloodstream, and the majority is eventually excreted.

(b) ***Ingestion*** is the process by which lead or lead compounds may be introduced into the digestive tract by swallowing the dust or where it is transferred to food, beverages, or tobacco. Much may be excreted directly but some will pass to the bloodstream.

(c) ***Absorption*** is the process by which lead from certain organic compounds, such as the tetraethyl lead in gasoline, may pass through pores in the skin.

**2.04** Since lead is a toxic substance, excessive quantities taken into the body can cause a variety of clinical effects ranging from minor disorders to serious physical damage, or even death. The degree of severity is dependent on the amount of lead absorbed and the duration of high body levels. The health hazards of lead have long been recognized in industries using significant quantities. The possibility of acute lead poisoning has largely been eliminated from those occupations. However, the potential for chronic lead intoxication does exist for workers in lead-related industries.

**2.05** Signs and symptoms of severe lead intoxication are well known from observations of excessively exposed workers (lead miners, smelters, battery plant operators, etc). Symptoms include loss of appetite, metallic taste in the mouth, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pains, fine tremors, numbness, dizziness, hyperactivity, and colic. These signs and symptoms ***do not*** usually occur until the PbB has reached 80 $\mu g/100g$ and above. Some mild reversible effects, however, have been observed between 40 and 80 $\mu g/100g$ of whole blood.

***There are some exceptions to the blood lead levels noted above. Blood lead levels that are safe for adults may adversely affect the course of pregnancy or a developing fetus. Also, there is the possibility that elevated blood lead levels may adversely affect the course of reproduction in both males and females. For these reasons it is recommended that the blood lead levels for male and female workers who intend to have children be maintained below 30 $\mu g/100g$ of whole blood, thus minimizing the possibility of adverse reproductive health effects.***

**2.06** While PbB measurments only show the amount of lead circulating in the bloodstream

and not what is stored in body tissues, research has shown PbBs to be an important indicator of the absorption of lead by the body and of the possibility of lead-related health impairment or disease.

**2.07** Elevated exposure to lead also has a gradual effect of increasing the amount of a substance called zinc protoporphyrin (ZPP) in the red blood cells of the body. Tests for ZPP are easily performed and are useful in assessing the cumulative effects of lead exposure over longer time periods (up to 120 days). These characteristics of ZPP make it well suited as a screening technique.

## 3. POTENTIAL SOURCES

**3.01** To meet requirements that no employees be exposed to lead in excess of the PEL, it is first necessary to identify the potential Bell System sources of exposure.

**3.02** The most prevalent Bell System source of lead, and hence potential lead exposure, involves direct contact with lead sheathed cable.

**3.03** Bell Laboratories and AT&T conducted a large scale survey among those employees to assess operating company potential exposure to airborne lead.

**3.04** Procedures used to evaluate employee lead exposure are those outlined by NIOSH. They involve collection of air samples from the breathing zone of a technician while engaged in representative work tasks during an entire workshift. The instrumentation used is a battery powered pump which samples air from the breathing zone through a filter on which airborne lead is deposited. Filters are then analyzed in the laboratory for the amounts of collected lead. Eight-hour TWA lead concentrations can then be calculated and compared to OSHA standards.

**3.05** Studies showed that the job activities having the ***potential*** for exposure levels above the PEL are lead cable removal, sheath preparations associated with lead wiping and cable repair work (aerial and underground), and reracking underground cables.

**3.06** The components of the particles released are lead oxides and some elemental lead. The size and quantity of released particles are significantly dependent on the length of time the cable has been installed (the older the cable, the more potential for particle release), the environment in which the cable was installed and the specific work operation (vigorous carding or reracking versus minimal sheath disturbance). Employee exposure depends heavily on the work location (inside a manhole versus outdoors and upwind of the lead source) and if the ambient conditions and/or the cable are damp or dry.

**3.07** The significant reduction in recent years in the use of lead sheathed cable has reduced the potential for lead exposure. There are some limited environments (eg, areas with potential petroleum contaminants) which still require new lead sheaths. Since these new sheaths have not yet severely oxidized, potential exposure while handling is not a Bell System problem as long as standard work practices and good personal hygiene habits are followed.

**3.08** Similarly, it has been found that soldering and lead wiping do not release sufficient lead fume to present a hazard.

***In the case of lead wiping, care should be exercised to keep the lead at its proper wiping temperature (below 800°F). Lead fumes begin to be created at temperatures of 1000°F and above; however, at those temperatures the lead is too hot to properly wipe.***

**3.09** Bell System documentation has been issued (paragraph 1.03) covering controls that are to be used during work operations which have been identified as having the potential for exposures above the PEL. It is imperative that those practices be followed.

**3.10** Of special importance for exposure control is the practice of good personal hygiene habits by all personnel who work in areas where lead may be present. Details are covered in appropriate Bell System Practices and summarized as follows for special emphasis purposes:

- Keep food, beverages, and tobacco products away from proximity to work operations.
- Always wash hands and face prior to eating, drinking, smoking, or applying cosmetics.
- Where protective clothing is used (coveralls, boots, etc), put them on and take them off at the work site.

- Properly handle and/or dispose of lead contaminated debris and clothing.

## 4. LEGAL REQUIREMENTS

**4.01** The OSHA standard for occupational exposure to lead became effective on March 1, 1979, and is published in its entirety in 29CFR 1910.1025 and Appendices A, B, C and D. The following paragraphs outline those requirements as they apply to Bell System personnel.

**4.02** The purpose of the standard is the prevention of adverse health effects from either acute short term or chronic long term overexposure to lead.

**4.03** ***PEL:*** The permissible limit of occupational exposure to lead is 50 micrograms per cubic meter of air (50 $\mu g/m^3$) averaged over an 8-hour work period (TWA). It is a corporate responsibility to identify those portions of the workplace that contain lead, provide environmental monitoring to determine the level of exposure, and institute controls to ensure employees are not exposed above the PEL.

***Note:*** The 8-hour time-weighted average is calculated by the formula:

$$\frac{C_1\ T_1\ +\ C_2\ T_2\ \text{---CnTn}}{480 \text{ minutes}}$$

where: C = Lead concentration in $\mu g/m^3$ of air

T = Time period of sample in minutes

**4.04** ***Action Level:*** Employees who are exposed to lead concentrations greater than 30 $\mu g/m^3$ of air averaged over an 8-hour work period (TWA) for more than 30 days per year must be placed in a medical surveillance program. The program includes PbB tests and medical examinations, and follow-up monitoring of the PbB at specified time intervals which vary with the initial PbB test results. Surveillance and monitoring are provided at no cost to the employee.

**4.05** ***Controls:*** In order to meet the PEL requirements, controls are required by the employer. They are prioritized as follows:

(a) ***Engineering Controls*** — Employ mechanical means or product substitution to eliminate, divert, or isolate lead emissions so employees are not exposed to harmful concentrations.

(b) ***Work Practices and Administrative Controls*** — Institution of work practices or methods to contain the contaminant such that airborne lead is reduced or eliminated. Administrative controls involve employee rotation to reduce daily TWA exposure.

(c) ***Personal Protective Equipment*** — The use of respirators and other protective measures such as coveralls, boots, headcoverings, etc. These measures do not reduce emissions, but isolate the employee from the contaminant.

***OSHA has adopted the position that other types of controls are preferable to the use of respirators because of difficulties in ensuring that the devices are properly maintained and used (Section 010-170-001). To date no traditional Teleco operations involving airborne lead have been discovered which would require their use if proper work practices are followed.***

**4.06** ***Removal Protection:*** Exposed employees whose PbB tests are at or above 50 $\mu g/100g$ of whole blood must be removed from the exposure and not returned until two successive tests indicate levels at or below 40 $\mu g/100g$ of whole blood. This must be done with no penalty to the employee (earnings, seniority, etc.).

**4.07** ***Written Notification:*** If employees are exposed to lead and air sampling is performed, they must be notified within 5 working days after monitoring results are known. This is true for the individual monitored and any other employees for whom the sampling is representative. Notification is also required when PbB testing indicates levels at or above 40 $\mu g/100g$ of whole blood.

**4.08** ***Employee Option:*** Employees participation in the medical surveillance program is strongly recommended as a matter of personal health care. It is, however, optional under the law.

**4.09** ***Training:*** Employees who work in an environment with potential exposure to airborne lead must be informed of the contents of the standard and its appendices and be updated annually. Annual updates must include:

(a) Operations which could result in exposures above the action level

(b) Limitations, selection, fitting, and use of respirators (Section 010-170-001)

(c) Purpose and description of medical surveillance, removal protection, and adverse health effects associated with excessive exposure to lead (including reproductive effects on males and females)

(d) Controls and work practices associated with job assignment of employee

(e) Contents of any compliance plan in effect

(f) Instructions on the prohibition of routine use of chelating agents (drugs used to reduce lead absorption in body tissues).

**4.10** ***Record keeping:*** The employer must maintain records on exposure monitoring, medical surveillance, and medical removal from the job. Exposure monitoring and medical surveillance records must be retained for 40 years, or 20 years beyond termination of employment, whichever is longer, and medical job removal records for the duration of employment. Specific records must contain the following:

(a) ***Exposure Monitoring*** — Date, number, duration, location, description, and results of each sample taken; description of analytical methods used; type of respiratory protection used (if any); name, social security number, and job class of monitored employee; and other environmental variables which could affect employee exposure measurement.

(b) ***Medical Records*** — Name, social security number, and description of employee duties; written opinion of physician; results of airborne exposure levels; medical conditions directly related to lead; medical examination results; medical and work history; description of laboratory procedures; interpretations of test results; and biological monitoring results.

(c) ***Medical Job Removal*** —Name and social security number of employee; dates of job removal and return for each occasion; explantion of how removal was accomplished; and statement whether removal was due to elevated PbB.

## 5. SPECIFIC RESPONSIBILITIES

### A. Corporate

**5.01** Corporate responsibilities are defined as the overall responsibilities of the operating company which are administered jointly by the office of the District Staff Manager of Safety and the the Company Medical Department. Their responsibilities include:

(1) Overall legal responsibility of providing and maintaining the workplace free of airborne lead above the PEL.

(2) Engineering, work practice, and administrative controls; employee information and training; protective devices (clothing, respirators, etc), and medical surveillance.

(3) Continued environmental monitoring to evaluate and ensure the effectiveness of the controls and work practices.

### B. Supervisory

**5.02** Supervisory responsiblities are those defined as falling to various levels of local supervision in pursuit of the corporate goals. These responsibilities include:

(1) Dissemination of employee information and implementation of orientation and training programs on the health hazards of airborne lead.

(2) Recognition of unusual situations so that potential problems can be resolved as they arise.

(3) Encouragement of voluntary participation of technicians in surveillance programs and enforcement of work practices.

### C. Craft

**5.03** Craft responsibilities are those defined as the personal responsibilities of each employee who is potentially exposed to the hazards of airborne lead. Each employee is responsible as follows:

(1) Following the work practices, with special emphasis on personal hygiene.

(2) Promptly reporting of questionable environments and personal symptoms which may indicate lead exposure.

(3) Cooperating in follow-up monitoring to ensure that work practices are effective in protecting their personal health.